IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of SHIRLEY J. JAMES

Atty. Docket PHB 34-056C

Serial No.

Filed: CONCURRENTLY

Title: RECORDING AND/OR REPLAYING TELETEXT SIGNALS

Commissioner for Patents
Washington, D.C. 20231

AMENDMENT

Sir:

Prior to calculation of the filing fee and examination, please amend the above-identified application as follows:

IN THE ABSTRACT

Please cancel the present Abstract and substitute the rewritten Abstract shown on the page attached hereto.

IN THE SPECIFICATION

Page 1, in the paragraph beginning on line 5, change as follows:

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to the field of recording and/or replaying standard video data using a video recorder.

Page 1, in the paragraph beginning on line 8, change as follows:

2. Description of the Related Art

It is well known that it is not possible to reliably record and

principally because the bandwidth of the VHS channel is very limited. The luminance bandwidth is 2.9 - 3MHz which can be reduced to 2MHz on playback when the sharpness control is set to "soft". As a comparison the bandwidth of a normal broadcast video channel is of the order of 5.5 MHz. The limited VHS bandwidth has proved acceptable with normal video signals, the effect being to soften or blur the picture to an extent which has proved to be acceptable to most viewers. When teletext was first specified, however, a high bit rate was chosen to make maximum use of the broadcast bandwidth. Unfortunately, this means that the high frequency part of the data signal, including the very important clock run-in signal, is obliterated by the recording and replay process. In addition most teletext decoders rely on the very close line timing tolerances achieved by broadcast transmissions. The decoders can be completely upset by synchronising jumps created just before the vertical blanking interval (VBI) by the recorder head switching. Further problems are caused by the variation in line frequency caused by stretched tapes which can cause a variation of $\pm$ 3% in line frequency.

Page 1, in the paragraph beginning on line 1, change as follows:

It has been proposed in EP-A- 0 608 960 (PHB 33832) , corresponding to U.S.P. 5,565,997, issued Oct. 15, 1996, that teletext data should be recorded on VHS tapes at a lower bit rate by decoding the teletext data and expanding the data packets by a factor of four. This data is then spread across five VBI lines, to allow for guard periods. On replay the data packets from the five

lines are compressed to restore the data rate to that in the teletext specification to enable display of the data. Such an arrangement enables the teletext data to be recorded on and replayed from a VHS recorder but suffers from the disadvantage that it is impossible to record all the teletext pages that are transmitted as there are insufficient VBI lines to accommodate them. Consequently a selection of the pages to be recorded has to be made at the time of recording and as a result only those selected pages can be displayed when the tape is replayed.

Page 2, on line 15, insert the following new paragraph:

The above citations are hereby incorporated herein in whole by reference

Page 2, in the paragraph beginning on line 16, change as follows:

SUMMARY OF THE INVENTION

It is an object of the invention to enable the provision of a method of and apparatus for recording and/or replaying teletext data using a video recorder having a bandwidth of less than the bandwidth of a broadcast channel, as a result of which it is possible to record and/or replay all the teletext data transmitted.

Page 2, in the paragraph beginning on line 24, change as follows:

The invention provides a method of recording teletext data on a record carrier using a recording apparatus having a bandwidth of less than the standard teletext data rate , including the steps of

- receiving teletext data at the standard data rate,

- converting the teletext data to a multilevel code, at a data rate which falls within the bandwidth of the recording apparatus, and
- recording the multilevel code on the record carrier.

Page 2, in the paragraph beginning on line 29, change as follows:

By converting the teletext data to a multilevel code the data rate can be reduced. For example a four level (or quaternary) code allows two bits to be encoded for each data period and consequently allows the data rate to be halved. By this means the teletext data transmitted in one VBI line can be recorded to a single VBI line in the recorder without requiring broadcast bandwidth. Consequently it is then possible to record all the teletext data broadcast as part of a programme which is being recorded. This means that it is not necessary at the time the recording is being made to decide which teletext data to record and that this choice can be made from the total transmitted data at the time the programme is being replayed.

Page 3, in the paragraph beginning on line 9, change as follows:

The multilevel code may include a signal having more than two amplitude levels. In this case the multilevel code is coded in terms of signal amplitude. An alternative would be to provide a multi phase signal, a four phase signal giving the same possibility of encoding two bits in each data period. Of course, a combination of phase and amplitude could be used to form the multilevel code.

Page 3, in the paragraph beginning on line 21, change as follows:

The invention further provides a method of replaying teletext data from a record carrier using replay apparatus having a bandwidth of less than the standard teletext data rate, the teletext data being recorded on the record carrier by means of a multilevel code at a data rate which is lower than the standard teletext data rate, the method including the steps of

- reading the multilevel code from the record carrier,
- converting the multilevel code to standard teletext data, and
- applying the teletext data to a teletext encoder.

Page 3, in the paragraph beginning on line 29, change as follows:

The data recorded on the record carrier may be by the method according to the invention when the recording apparatus is used to record a broadcast programme (including cable television), or may be inserted on the record carrier from a pre-recorded tape or disc.

Page 4, in the paragraph beginning on line 4, change as follows:

The invention still further provides apparatus for recording teletext data on a record carrier, the recording apparatus having a bandwidth of less than the standard teletext data rate, the apparatus for receiving a video signal including teletext data, apparatus for detecting received valid teletext data, apparatus for encoding the received teletext data into a multilevel code at a data rate which is less than the standard teletext data rate, and apparatus for recording the multilevel code on the record carrier.

Page 4, in the paragraph beginning on line 11, change as follows:

The apparatus for encoding teletext data may include apparatus for applying the received teletext data to an encoder in n-bit packets, where n is an integer greater than one, apparatus for converting each n-bit packet into a multilevel code having at least one level for each n-bit combination, and apparatus for feeding the multibit code to the record head of the recoder at a data rate of 1/n times the standard teletext data rate.

Page 4, in the paragraph beginning on line 18, change as follows:

The packets may be of two or three bits, which correspond to four or eight level codes respectively. The four level code allows the data rate to be halved whereas the eight level code will allow it to be reduced to one third of the original rate. The more levels allowed the greater the reduction in data rate but the greater the difficulty in distinguishing between them.

Page 4, in the paragraph beginning on line 23, change as follows:

A buffer RAM may be connected between the apparatus for detecting teletext data and the encoder.

Page 4, in the paragraph beginning on line 25, change as follows:

This enables timing to be simplified. It will be apparent that some time is needed to detect that teletext signals are being received on any given VBI line. Therefore, to encode and reinsert the data on the same VBI line would require very fast decisions and encoding. By providing a buffer store the data can be reinserted either on a succeeding line of the VBI, if available, or on a line

in the VBI of the next field or frame.

Page 4, in the paragraph beginning on line 31, change as follows:

The buffer RAM may receive only teletext data packets, the encoder including apparatus for generating the clock run in and framing code.

Page 5, in the paragraph beginning on line 5, change as follows:

The invention still further provides apparatus for replaying teletext data from a record carrier, the teletext data being encoded by means of a multilevel code at a data rate less than the standard teletext data rate, the apparatus including apparatus for feeding the multilevel code signal to a decoder which is arranged to convert the multilevel code to a binary code at the standard teletext data rate and apparatus for multiplexing the binary code with the video signal for application to a teletext decoder.

Page 5, in the paragraph beginning on line 12, change as follows:

The data may have been recorded on the tape by the method or apparatus set forth hereinbefore or may have been produced on a pre-recorded tape. This may particularly be the case for a proposed teletext version of the V chip code which is proposed as a means of encoding broadcast or tape material as to its category as far as, for example, violent scenes or scenes of a sexual nature are concerned. This enables television sets to either display the category or to scramble or de-scramble the video signal depending on the category encoded and on that entered into the television set

by a user having appropriate authorization, for example by PIN number.

Page 5, in the paragraph beginning on line 24, change as follows:

Data from the decoder may be written into a buffer RAM. The apparatus may further include a teletext encoder, the teletext encoder being arranged to receive data from the buffer RAM. The teletext encoder may include apparatus for generating the clock run-in and framing code.

Page 6, in the paragraph beginning on line 1, change as follows:

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other features and advantages of methods and apparatus according to the invention will be apparent from the following description, by way of example, of an embodiment of the invention with reference to the accompanying drawings in which:-

Figs. 1a and 1b respectively show a standard broadcast teletext signal and the effect of the restricted bandwidth of a VHS video recorder on this signal,

Figure 2 shows a four level code representing the broadcast teletext signal which is suitable for recording on and replay from a VHS recorder,

Figure 3 shows on an enlarged time scale a portion of the signal shown in Figure 2.

Page 6, in the paragraph beginning on line 22, change as follows:

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Figure 1(a) shows a standard teletext signal as received by a receiver. The data rate of the teletext signal is greater than 5 MHz and consequently such a signal will be distorted when it is fed through a video recorder such as one according to the VHS standard which has a channel bandwidth of around 3MHz. Figure 1(b) shows how the teletext signal is affected by the channel band width of a typical VHS recorder. As can be seen the initial clock run-in information is lost and on replay such a signal would not be decodable by standard teletext decoder.

Page 7, in the paragraph beginning on line 14, change as follows:

Thus a method of recording teletext data according to the invention includes the steps of receiving the teletext data at the standard data rate and then converting the teletext data into a multilevel code at a data rate which is lower than that of the standard teletext signal. The multilevel code is then applied to the record head of the recorder to enable the data to be recorded on the tape. In this particular embodiment a four amplitude level code is used and the data rate is half that of the standard teletext signal. If an eight level code was used then the data rate could be reduced to one third of the standard teletext data rate since an eight level code would allow each data period to encode three bits.

Page 7, in the paragraph beginning on line 24, change as follows:

While it is preferred, however, to use a multiple amplitude level code as this simplifies the recovery of data by a standard

teletext decoder, it is possible either to use a multilevel code including a number of different phases or to use a combination of phase and amplitude levels.

Page 8, in the paragraph beginning on line 2, change as follows:

Figure 4 is a block diagram of a video recorder which is capable of carrying out the methods of recording teletext data and replaying teletext data according to the invention. The video recorder shown in Figure 4 includes an aerial 1 which is connected to a tuner 2. The tuner 2 feeds an intermediate frequency stage 3 whose output is fed to a demodulator 4 which produces at its output a combined video and blanking signal (CVBS). The combined video and blanking signal is fed to the input of a teletext decoder 5 whose output is connected to a buffer RAM 6. The buffer RAM 6 is connected to an encoder 7 which produces from the data read from the RAM 6 the multilevel code for recording on the tape. The output of the encoder 7 is fed to a first input of a multiplexer 8 whose second input receives the combined video and blanking signal from the output of the demodulator 4. A control and timing signal generator 9 produces a signal which causes the signal at either the first or the second input to be fed to the multiplexer output. As a result CVBS and the teletext data are available at the output of the multiplexer 8 at the appropriate times. The output of the multiplexer 8 is fed to the normal luminance processing circuitry 10 of the video recorder from whence it passes to the record and replay head 11 of the recorder. The CVBS is also applied from the output of the demodulator 4 to the control and timing generator 9. Thus

various timing signals can be derived from the line and field synchronising pulses in the CVBS in a standard manner within the control and timing signal generator 9. The teletext decoder 5 detects that teletext signals are being transmitted and that valid data is being received. Thus it will detect the clock run in and framing codes and generate a signal which is passed to the control and timing signal generator 9. The generator 9 then produces a control signal which is applied to the RAM 6 to cause the remaining data in a line to be written into the buffer RAM 6. As this detection takes some time it is necessary to include the buffer RAM 6 to enable timing to be properly achieved. The buffer RAM may delay the insertion of the teletext signal by one or more line periods or a field or frame period. The shorter the period of delay the smaller the size of RAM required.

Page 9, in the paragraph beginning on line 18, change as follows:

On replay the CVBS signal which contains the teletext data encoded according to the method of the invention is read from the tape by the tape head 11 and fed by the luminance processing circuitry 10 to a decoder 13 and to the control and timing generator 9. The decoder 13 detects the levels of the teletext portion of the signal and converts the encoded teletext signal to a teletext code. Thus at each data period the encoded teletext signal is converted into two bits which are fed to the RAM 6. The decoder 13 will include apparatus for detecting the encoded clock run in period and framing code to determine the start of the teletext data and to determine that in fact a teletext signal has been produced from the

tape. The fact that a clock run in and framing code has been detected will be signalled to the control and timing signal generator 9 which will then control the writing of the data produced at the output of the decoder 13 from the multilevel code applied to its input into the RAM 6.

Page 10, in the paragraph beginning on line 4, change as follows:

Preferably the data read into the RAM 6 will not include the clock run in and framing code as this is constant for each line of the teletext signal and consequently the storage capacity needed for that part of the signal would be superfluous. By this means, the size of the buffer RAM 6 can be minimised.

Page 12, in the paragraph beginning on line 11, change as follows:

Figure 6 shows in greater detail an embodiment of a decoder suitable for use as the decoder 13 of Figure 4. As shown in Figure 6 the decoder has an input 130 which receives the signal from the luminance processor 10 and a second input 131 which receives control and timing signals from the control and timing signal generator 9. The input signal from the luminance processor 10 is applied to the input of an equaliser 132 whose output is fed to a data slicer and clock recovery circuit 133. The equaliser 132 may be formed as decision feed back equaliser, in which case the output of the data slicer is fed back to equaliser 132. The output of the data slicer is also connected to a framing code detector 134. This detects when a framing code is present and has an output which is fed to a four level to binary code converter 135. The output of the data slicer

133 is also connected to the converter 135. The code converter 135 takes the four level signal and converts it to two binary digits at the standard teletext data rate using timing pulses from the control and timing signal generator 9 and appropriately is enabled or disabled by the output of the framing code detector 134 to ensure that the data converted by the code converter is in fact teletext data. The output of the code converter 135 is fed to an output 136 which is connected to the buffer RAM 6. Thus the decoder 13 takes the four level signal from the luminance processor 10 and converts it in each data period into two bits at the teletext data rate. These bits are then fed into the RAM 6 from whence they will be fed to the teletext encoder 14 at the appropriate time under the control of the control and timing signal generator 9. The output of the framing code detector is also fed to an output 137 which is connected to the control and timing signal generator 9 to enable it to control the writing of the teletext data into the RAM 6.

Page 12, in the paragraph beginning on line 27, change as follows:

The use of the equaliser 132 is not essential but is desirable in order to achieve acceptable performance. Whether or not the equaliser is required will depend very largely on the channel characteristics of the video recorder and how much noise is introduced into the signal before it is applied to the decoder 13. It is believed that the use of the equaliser 132 is necessary if it is required to produce a comparable performance to that obtained when teletext is decoded directly off air when reproducing teletext recorded on a VHS recorder using the present invention.

Page 13, in the paragraph beginning on line 4, change as follows:

Figure 7 shows in greater detail one embodiment of the data slicing function of the decoder of Figure 6. As shown in Figure 7 the CVBS output from the luminance processor 10 is fed to the input 130. An analogue to digital converter 140 converts the CVBS signal to an n-bit digital signal and applies it to a FIR filter 141 which forms a notch filter to remove any colour sub-carrier components. The n-bit output of the filter 141 is connected to the input of a teletext clock generator 142, to a run in detector 143, and to a decision feedback equaliser 144. The output of the teletext clock generator 142 is connected to a first input of a multilevel (four) level adaptive data slicer 145, the output of the run in detector 143 is connected to a second input of the data slicer 145, and the n-bit output of the equaliser 144 is connected to a third input of the data slicer 145.

Page 15, in the paragraph beginning on line 22, change as follows:

As seen in Fig. 4 the teletext encoder 14 will receive from the control and timing signal generator 9 a signal when the start of a line on which the teletext signal is to be inserted occurs. The teletext encoder 14 will include a clock run in and framing code generator as this will enable the RAM 6 not to include storage capacity for those particular parts of a teletext line since they are common to all teletext lines. At the end of the framing period data is read from the RAM 6 to the teletext encoder 14 which also receives from the control and timing signal generator 9 the teletext

clock which has been derived from the teletext signal replayed from the tape and is thus correctly timed with respect to the video signal replayed from the tape.

Page 16, in the paragraph beginning on line 20, change as follows:

It will be apparent that the details of the control and timing generator 9 shown in Figure 8 are those which are relevant to the writing in and reading out of data to the RAM 6. The control and timing circuit 9 will also include conventional timing generation apparatus to enable television line numbers and fields to be identified and appropriate signals generated to control the multiplexers 8 and 15 and the encoders 7 and 14 and decoder 13. These consist of clock signals related to the line frequency and selecting appropriate ones of the television lines for insertion of the teletext data.

Page 17, in the paragraph beginning on line 3, change as follows:

From reading the present disclosure, other modifications will be apparent to persons skilled in the art. Such modifications may involve other features which are already known in the design and use of teletext and video recorder circuits and data encoding techniques and circuits and component parts thereof and which may be used instead of or in addition to features already described herein. Although claims have been formulated in this application to particular combinations of features, it should be understood that the scope of the disclosure of the present application also includes any novel feature or any novel combination of features disclosed

herein either explicitly or implicitly or any generalisation of one or more of those features which would be obvious to persons skilled in the art, whether or not it relates to the same invention as presently claimed in any claim and whether or not it mitigates any or all of the same technical problems as does the present invention.

IN THE CLAIMS

Please amend the claims as follows:

1. (amended) A method of recording teletext data comprising the steps of:

receiving teletext data at a standard data rate of teletext data;

converting the teletext data to a multilevel code having more than two code levels, at a data rate which is lower than the standard data rate of the teletext data; and

recording the multilevel code on a record carrier.

2. (amended) The method of Claim 1 in which the multilevel code includes a signal having more than two amplitude levels that provide respective code levels.

3. (amended) The method of Claim 1 in which the multilevel code has four code levels and the lower data rate is half of the standard teletext data rate.

4. (amended) The method of Claim 1 in which the multilevel code has eight code levels and the lower data rate is one third of the standard teletext data rate.

5. (amended) A method of replaying teletext data comprising the steps of:

reading a multilevel code from a record carrier, the multilevel code having more than two code levels;

converting the multilevel code to standard teletext data, and

applying the teletext data to a teletext encoder.

6. (amended) Apparatus for recording teletext data, comprising:

means for receiving a video signal including teletext data,

means for detecting received valid teletext data,

means for encoding the received teletext data into a multi-level code having more than two code levels, at a data rate which is less than the standard teletext data rate, and

means for recording the multilevel code on the record carrier.

7. (amended) The apparatus of Claim 6 in which the means for encoding teletext data include:

means for applying the received teletext data to an encoder in n-bit packets, where n is greater than one,

means for converting each n-bit packet into a multilevel code having at least one level for each n-bit combination, and

means for feeding the multibit code to the recording head of the recorder at a data rate of 1/n times the standard teletext data rate.

8. (amended) The apparatus of Claim 7 in which n=2.

9. (amended) The apparatus of Claim 7 in which n=3.

10. (amended) The apparatus of Claim 6 further comprising a buffer RAM connected between the means for detecting teletext data and the means for encoding.

11. (amended) The apparatus of Claim 10 in which:

the buffer RAM receives only teletext data packets; and

the encoding means generate a clock run in and a framing code.

12. (amended) The apparatus of Claim 6 in which the multilevel code includes a plurality of amplitude levels that provide respective code levels.

13. (amended) Apparatus for replaying teletext data , comprising:

means for feeding a multilevel code signal having more than 2 code levels, to a decoder to convert the multilevel code to a binary code at the standard teletext data rate; and

means for multiplexing the binary code with the video signal for application to a teletext decoder.

14. (amended) The apparatus of Claim 13 in which the multilevel code is a four level code and the decoder produces two bits from each four level code.

15. (amended) The apparatus of Claim 13 in which the multilevel code is an eight level code and the decoder produces three bits from each eight level code.

16. (amended) The apparatus of Claim 13 in which data from the decoder is written into a buffer RAM.

17. (amended) The apparatus of Claim 16 further comprising a teletext encoder to receive data from the buffer RAM.

18. (amended) The apparatus of Claim 16 in which the teletext encoder includes means for generating the clock run-in and framing code.

19. (amended) The apparatus of Claim 13 in which the decoder includes an equalizer.

20. (amended) The apparatus of 9 in which the equalizer is a decision feedback equalizer.

21. (amended) The apparatus of Claim 13 in which the multilevel code includes a plurality of amplitude levels that provide respective code levels.

Please add the following new claims:

22. The method of claim 1 in which the multilevel code includes a signal having a first phase and one or more additional phases that provide respective code levels.

23. The apparatus of claim 6 in which the multilevel code includes a signal having a first phase and one or more additional phases that provide respective code levels.

24. The method of claim 13 in which the multilevel code includes a signal having a first phase and one or more additional phases that provide respective code levels.

25. The method of Claim 1 in which:

the multilevel code includes a signal having more than two amplitude levels;

the multilevel code includes a signal having more than one phase; and

the multilevel code has four code levels and the lower data rate is half of the standard teletext data rate or the multilevel code has eight code levels and the lower data rate is one third of the standard teletext data rate.

26. The method of Claim 5 in which:

the multilevel code includes a signal having more than two

amplitude levels;

the multilevel code includes a signal having more than one phase; and

the multilevel code has four code levels and the multilevel code has a data rate of half of the standard teletext data rate or the multilevel code has eight code levels and the multilevel code has a data rate of one third of the standard teletext data rate.

26. The apparatus of Claim 6 in which

the means for encoding teletext data include:

means for applying the received teletext data to an encoder in n-bit packets, where n is greater than one,

means for converting each n-bit packet into a multilevel code having at least one level for each n-bit combination, and

means for feeding the multibit code to the record head of the recorder at a data rate of 1/n times the standard teletext data rate;

n=2 or n=3;

a buffer RAM is connected between the means for detecting teletext data and the encoder;

the buffer RAM receives only teletext data packets; and

the encoder includes means for generating the clock run in and framing code;

the multilevel code includes three or more amplitude levels; and

the multilevel code includes a plurality of signal phases.

27. The apparatus of Claim 13 in which:

the multilevel code is selected from: a four level code and the decoder produces two bits from each four level code; and an eight level code and the decoder produces three bits from each eight level code;

data from the decoder is written into a buffer RAM;

the apparatus further comprises a teletext encoder to receive data from the buffer RAM;

the teletext encoder includes means for generating the clock run-in and framing code;

the decoder includes an equalizer;

the equalizer is a decision feedback equalizer;

the multilevel code includes a plurality of amplitude levels; and

the multilevel code includes a plurality of phases.

REMARKS

REMARKS

Respectfully submitted,

By Michael E. Belk

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(914) 333-9640

APPENDIX A

Amended Specification

Page 1, in the paragraph beginning on line 5, change as follows:

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to ~~a method of and apparatus for~~ the field of recording and/or replaying ~~teletext~~ standard video data using a video recorder.

Page 1, in the paragraph beginning on line 8, change as follows:

2. Description of the Related Art

It is well known that it is not possible to reliably record and replay teletext data using a standard VHS video cassette recorder, principally because the bandwidth of the VHS channel is very limited. The luminance bandwidth is 2.9 - 3MHz which can be reduced to 2MHz on playback when the sharpness control is set to "soft". As a comparison the bandwidth of a normal broadcast video channel is of the order of 5.5 MHz. The limited VHS bandwidth has proved acceptable with normal video signals, the effect being to soften or blur the picture to an extent which has proved to be acceptable to most viewers. When teletext was first specified, however, a high bit rate was chosen to make maximum use of the broadcast bandwidth. Unfortunately, this means that the high frequency part of the data signal, including the very important clock run-in signal, is obliterated by the recording and replay process. In addition most

teletext decoders rely on the very close line timing tolerances achieved by broadcast transmissions. The decoders can be completely upset by synchronising jumps created just before the vertical blanking interval (VBI) by the recorder head switching. Further problems are caused by the variation in line frequency caused by stretched tapes which can cause a variation of $\pm$ 3% in line frequency.

Page 1, in the paragraph beginning on line 1, change as follows:

It has been proposed in EP-A- 0 608 960 (PHB 33832) corresponding to U.S.P. 5,565,997, issued Oct. 15, 1996, that teletext data should be recorded on VHS tapes at a lower bit rate by decoding the teletext data and expanding the data packets by a factor of four. This data is then spread across five VBI lines, to allow for guard periods. On replay the data packets from the five lines are compressed to restore the data rate to that in the teletext specification to enable display of the data. Such an arrangement enables the teletext data to be recorded on and replayed from a VHS recorder but suffers from the disadvantage that it is impossible to record all the teletext pages that are transmitted as there are insufficient VBI lines to accommodate them. Consequently a selection of the pages to be recorded has to be made at the time of recording and as a result only those selected pages can be displayed when the tape is replayed.

Page 2, on line 15, insert the following new paragraph:

The above citations are hereby incorporated herein in whole by

reference

Page 2, in the paragraph beginning on line 16, change as follows:

SUMMARY OF THE INVENTION

It is an object of the invention to enable the provision of a method of and apparatus for recording and/or replaying teletext data using a video recorder having a bandwidth of less than the bandwidth of a broadcast channel, as a result of which it is possible to record and/or replay all the teletext data transmitted.

Page 2, in the paragraph beginning on line 24, change as follows:

The invention provides a method of recording teletext data on a record carrier using a recording apparatus having a bandwidth of less than the standard teletext data rate , including the steps of

- receiving teletext data at the standard data rate,
- converting the teletext data to a multilevel code, at a data rate which falls within the bandwidth of the recording apparatus, and
- recording the multilevel code on the record carrier.

Page 2, in the paragraph beginning on line 29, change as follows:

By converting the teletext data to a multilevel code the data rate can be reduced. For example a four level (or quaternary) code allows two bits to be encoded for each data period and consequently allows the data rate to be halved. By this means the teletext data transmitted in one VBI line can be recorded to a single VBI line in the recorder without requiring broadcast bandwidth. Consequently it

is ~~now~~ then possible to record all the teletext data broadcast ~~with~~ as part of a programme which is being recorded. This means that it is not necessary at the time the recording is being made to decide which teletext data to record and that this choice can be made from the total transmitted data at the time the programme is being replayed.

Page 3, in the paragraph beginning on line 9, change as follows:

The multilevel code may ~~comprise~~ include a signal having more than two amplitude levels. In this case the multilevel code is coded in terms of signal amplitude. An alternative would be to provide a multi phase signal, a four phase signal giving the same possibility of encoding two bits in each data period. Of course, a combination of phase and amplitude could be used to form the multilevel code.

Page 3, in the paragraph beginning on line 21, change as follows:

The invention further provides a method of replaying teletext data from a record carrier using replay apparatus having a bandwidth of less than the standard teletext data rate, the teletext data being recorded on the record carrier by means of a multilevel code at a data rate which is lower than the standard teletext data rate, the method ~~comprising~~ including the steps of

- reading the multilevel code from the record carrier,
- converting the multilevel code to standard teletext data, and
- applying the teletext data to a teletext encoder.

Page 3, in the paragraph beginning on line 29, change as follows:

The data recorded on the record carrier may ~~have been~~ be by ~~means of~~ the method according to the invention when the recording apparatus ~~has been~~ is used to record a broadcast programme (including cable television), or may ~~have~~ be ~~been~~ inserted on the record carrier ~~by the producer of~~ from a pre-recorded tape or disc.

Page 4, in the paragraph beginning on line 4, change as follows:

The invention still further provides apparatus for recording teletext data on a record carrier, ~~said~~ the recording apparatus having a bandwidth of less than the standard teletext data rate, the apparatus ~~comprising means~~ for receiving a video signal including teletext data, ~~means~~ apparatus for detecting received valid teletext data, ~~means~~ apparatus for encoding the received teletext data into a multilevel code at a data rate which is less than the standard teletext data rate, and ~~means~~ apparatus for recording the multilevel code on the record carrier.

Page 4, in the paragraph beginning on line 11, change as follows:

The ~~means~~ apparatus for encoding teletext data may ~~comprise means~~ include apparatus for applying the received teletext data to an encoder in n-bit packets, where n is an integer greater than one, ~~means~~ apparatus for converting each n-bit packet into a multilevel code having at least one level for each n-bit combination, and ~~means~~ apparatus for feeding the multibit code to the record head of the recoder at a data rate of 1/n times the standard teletext data rate.

Page 4, in the paragraph beginning on line 18, change as follows:

The packets may be of two or three bits, which correspond to four or eight level codes respectively. The four level code allows the data rate to be halved whereas the eight level code will allow it to be reduced to one third of the original rate. The more levels allowed the greater the reduction in data rate but the greater the difficulty in distinguishing between them.

Page 4, in the paragraph beginning on line 23, change as follows:

A buffer RAM may be connected between the ~~means~~ apparatus for detecting teletext data and the encoder.

Page 4, in the paragraph beginning on line 25, change as follows:

This enables timing to be simplified. It will be apparent that some time is needed to detect that teletext signals are being received on any given VBI line ~~and~~. Therefore, to encode and reinsert the data on the same VBI line would require very fast decisions and encoding. By providing a buffer store the data can be reinserted either on a succeeding line of the VBI, if available, or on a line in the VBI of the next field or frame.

Page 4, in the paragraph beginning on line 31, change as follows:

The buffer RAM may receive only teletext data packets, the encoder including ~~means~~ apparatus for generating the clock run in and framing code.

Page 5, in the paragraph beginning on line 5, change as follows:

The invention still further provides apparatus for replaying teletext data from a record carrier, the teletext data being encoded by means of a multilevel code at a data rate less than the standard teletext data rate, the apparatus ~~comprising means~~ including apparatus for feeding the multilevel code signal to a decoder which is arranged to convert the multilevel code to a binary code at the standard teletext data rate and ~~means~~ apparatus for multiplexing the binary code with the video signal for application to a teletext decoder.

Page 5, in the paragraph beginning on line 12, change as follows:

The data may have been recorded on the tape by the method or apparatus set forth hereinbefore or may have been produced on a pre-recorded tape. This may particularly be the case for a proposed teletext version of the V chip code which is proposed as a means of encoding broadcast or tape material as to its category as far as, for example, violent scenes or scenes of a sexual nature are concerned. This enables television sets to either display the category or to scramble or de-scramble the video signal depending on the category encoded and on that entered into the television set by a user having appropriate authorization, for example by PIN number.

Page 5, in the paragraph beginning on line 24, change as follows:

Data from the decoder may be written into a buffer RAM. The apparatus may further ~~comprise~~ include a teletext encoder, the

teletext encoder being arranged to receive data from the buffer RAM. The teletext encoder may include ~~means~~ apparatus for generating the clock run-in and framing code.

Page 6, in the paragraph beginning on line 1, change as follows:

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other features and advantages of methods and apparatus according to the invention will be apparent from the following description, by way of example, of an embodiment of the invention with reference to the accompanying drawings in which:-

~~Figure 1 shows~~ Figs. 1a and 1b respectively show a standard broadcast teletext signal and the effect of the restricted bandwidth of a VHS video recorder on this signal,

Figure 2 shows a four level code representing the broadcast teletext signal which is suitable for recording on and replay from a VHS recorder,

Figure 3 shows on an enlarged time scale a portion of the signal shown in Figure 2.

Page 6, in the paragraph beginning on line 22, change as follows:

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Figure 1(a) shows a standard teletext signal as received by a receiver. The data rate of the teletext signal is greater than 5 MHz and consequently such a signal will be distorted when it is fed through a video recorder such as one according to the VHS standard which has a channel bandwidth of around 3MHz. Figure 1(b) shows how the teletext signal is affected by the channel band width of a

typical VHS recorder. As can be seen the initial clock run-in information is lost and on replay such a signal would not be decodable by standard teletext decoder.

Page 7, in the paragraph beginning on line 14, change as follows:

Thus a method of recording teletext data according to the invention ~~comprises~~ includes the steps of receiving the teletext data at the standard data rate and then converting the teletext data into a multilevel code at a data rate which is lower than that of the standard teletext signal. The multilevel code is then applied to the record head of the recorder to enable the data to be recorded on the tape. In this particular embodiment a four amplitude level code is used and the data rate is half that of the standard teletext signal. If an eight level code was used then the data rate could be reduced to one third of the standard teletext data rate since an eight level code would allow each data period to encode three bits.

Page 7, in the paragraph beginning on line 24, change as follows:

While it is preferred, however, to use a multiple amplitude level code as this simplifies the recovery of data by a standard teletext decoder, it is possible either to use a multilevel code ~~comprising~~ including a number of different phases or to use a combination of phase and amplitude levels.

Page 8, in the paragraph beginning on line 2, change as follows:

Figure 4 is a block diagram of a video recorder which is capable of carrying out the methods of recording teletext data and

replaying teletext data according to the invention. The video recorder shown in Figure 4 ~~comprises~~ includes an aerial 1 which is connected to a tuner 2. The tuner 2 feeds an intermediate frequency stage 3 whose output is fed to a demodulator 4 which produces at its output a combined video and blanking signal (CVBS). The combined video and blanking signal is fed to the input of a teletext decoder 5 whose output is connected to a buffer RAM 6. The buffer RAM 6 is connected to an encoder 7 which produces from the data read from the RAM 6 the multilevel code for recording on the tape. The output of the encoder 7 is fed to a first input of a multiplexer 8 whose second input receives the combined video and blanking signal from the output of the demodulator 4. A control and timing signal generator 9 produces a signal which causes the signal at either the first or the second input to be fed to the multiplexer output. As a result CVBS and the teletext data are available at the output of the multiplexer 8 at the appropriate times. The output of the multiplexer 8 is fed to the normal luminance processing circuitry 10 of the video recorder from whence it passes to the record and replay head 11 of the recorder. The CVBS is also applied from the output of the demodulator 4 to the control and timing ~~generating~~ generator 9. Thus various timing signals can be derived from the line and field synchronising pulses in the CVBS in a standard manner within the control and timing signal generator 9. The teletext decoder 5 detects that teletext signals are being transmitted and that valid data is being received. Thus it will detect the clock run in and framing codes and generate a signal which is passed to the control and timing signal generator 9. The generator 9 then produces a

control signal which is applied to the RAM 6 to cause the remaining data in a line to be written into the buffer RAM 6. As this detection takes some time it is necessary to include the buffer RAM 6 to enable timing to be properly achieved. The buffer RAM may delay the insertion of the teletext signal by one or more line periods or a field or frame period. The shorter the period of delay the smaller the size of RAM required.

Page 9, in the paragraph beginning on line 18, change as follows:

On replay the CVBS signal which contains the teletext data encoded according to the method of the invention is read from the tape by the tape head 11 and fed by the luminance processing circuitry 10 to a decoder 13 and to the control and timing generator 9. The decoder 13 detects the levels of the teletext portion of the signal and converts the encoded teletext signal to a teletext code. Thus at each data period the encoded teletext signal is converted into two bits which are fed to the RAM 6. The decoder 13 will include ~~means~~ apparatus for detecting the encoded clock run in period and framing code to determine the start of the teletext data and to determine that in fact a teletext signal has been produced from the tape. The fact that a clock run in and framing code has been detected will be signalled to the control and timing signal generator 9 which will then control the writing of the data produced at the output of the decoder 13 from the multilevel code applied to its input into the RAM 6.

Page 10, in the paragraph beginning on line 4, change as follows:

Preferably the data read into the RAM 6 will not include the clock run in and framing code as this is constant for each line of the teletext signal and consequently the storage capacity needed for that part of the signal would be superfluous. By this means, the size of the buffer RAM 6 can be minimised.

Page 12, in the paragraph beginning on line 11, change as follows:

Figure 6 shows in greater detail an embodiment of a decoder suitable for use as the decoder 13 of Figure 4. As shown in Figure 6 the decoder has an input 130 which receives the signal from the luminance processor 10 and a second input 131 which receives control and timing signals from the control and timing signal generator 9. The input signal from the luminance processor 10 is applied to the input of an equaliser 132 whose output is fed to a data slicer and clock recovery circuit 133. The equaliser 132 may be formed as decision feed back equaliser, in which case the output of the data slicer is fed back to ~~the~~ equaliser 132. The output of the data slicer is also connected to a framing code detector 134. This detects when a framing code is present and has an output which is fed to a four level to binary code converter 135. The output of the data slicer 133 is also connected to the converter 135. The code converter 135 takes the four level signal and converts it to two binary digits at the standard teletext data rate using timing pulses from the control and timing signal generator 9 and appropriately is enabled or disabled by the output of the framing code detector 134 to ensure that the data converted by the code converter is in fact teletext data. The output of the code converter 135 is fed to an

output 136 which is connected to the buffer RAM 6. Thus the decoder 13 takes the four level signal from the luminance processor 10 and converts ~~the four level data signal~~ it in each data period into two bits at the teletext data rate. These bits are then fed into the RAM 6 from whence they will be fed to the teletext encoder 14 at the appropriate time under the control of the control and timing signal generator 9. The output of the framing code detector is also fed to an output 137 which is connected to the control and timing signal generator 9 to enable it to control the writing of the teletext data into the RAM 6.

Page 12, in the paragraph beginning on line 27, change as follows:

The use of the equaliser 132 is not essential but is desirable in order to achieve ~~a reasonable~~ acceptable performance. Whether or not the equaliser is required will depend very largely on the channel characteristics of the video recorder and how much noise is introduced into the signal before it is applied to the decoder 13. It is believed that the use of the equaliser 132 is necessary if it is required to produce a comparable performance to that obtained when teletext is decoded directly off air when reproducing teletext recorded on a VHS recorder using the present invention.

Page 13, in the paragraph beginning on line 4, change as follows:

Figure 7 shows in greater detail one embodiment of the data slicing function of the decoder of Figure 6. As shown in Figure 7 the CVBS output from the luminance processor 10 is fed to the input 130. An analogue to digital converter 140 converts the CVBS signal

to an n-bit digital signal and applies it to a FIR filter 141 which forms a notch filter to remove any colour sub-carrier components. The n-bit output of the filter 141 is connected to the input of a teletext clock generator 142, to a run in detector 143, and to a decision feedback equaliser 144. The output of the teletext clock generator 142 is connected to a first input of a ~~three~~ multilevel (four) level adaptive data slicer 145, the output of the run in detector 143 is connected to a second input of the data slicer 145, and the n-bit output of the equaliser 144 is connected to a third input of the data slicer 145.

Page 15, in the paragraph beginning on line 22, change as follows:

~~The~~ As seen in Fig. 4 the teletext encoder 14 will receive from the control and timing signal generator 9 a signal when the start of a line on which the teletext signal is to be inserted occurs. The teletext encoder 14 will include a clock run in and framing code generator as this will enable the RAM 6 not to include storage capacity for those particular parts of a teletext line since they are common to all teletext lines. At the end of the framing period data is read from the RAM 6 to the teletext encoder 14 which also receives from the control and timing signal generator 9 the teletext clock which has been derived from the teletext signal replayed from the tape and is thus correctly timed with respect to the video signal replayed from the tape.

Page 16, in the paragraph beginning on line 20, change as follows:

It will be apparent that the details of the control and timing

generator 9 shown in Figure 8 are those which are relevant to the writing in and reading out of data to the RAM 6. The control and timing circuit 9 will also include conventional timing generation ~~means~~ apparatus to enable television line numbers and fields to be identified and appropriate signals generated to control the multiplexers 8 and 15 and the encoders 7 and 14 and decoder 13. These consist of clock signals related to the line frequency and selecting appropriate ones of the television lines for insertion of the teletext data.

Page 17, in the paragraph beginning on line 3, change as follows:

From reading the present disclosure, other modifications will be apparent to persons skilled in the art. Such modifications may involve other features which are already known in the design and use of teletext and video recorder circuits and data encoding techniques and circuits and component parts thereof and which may be used instead of or in addition to features already described herein. Although claims have been formulated in this application to particular combinations of features, it should be understood that the scope of the disclosure of the present application also includes any novel feature or any novel combination of features disclosed herein either explicitly or implicitly or any generalisation of one or more of those features which would be obvious to persons skilled in the art, whether or not it relates to the same invention as presently claimed in any claim and whether or not it mitigates any or all of the same technical problems as does the present invention. ~~The applicants hereby give notice that new claims may be formulated~~

~~to such features and/or combinations of such features during the prosecution of the present application or of any further application derived therefrom.~~

APPENDIX B

Amended Claims

1. (amended) A method of recording teletext data ~~on a record carrier using a recording apparatus having a bandwidth of less than the standard teletext data rate~~ comprising the steps of:

— receiving teletext data at ~~the~~ a standard data rate~~,~~ of teletext data;

– converting the teletext ~~date~~ data to a multilevel code having more than two code levels, at a data rate which is lower than the standard data rate of the teletext data; ~~falls within the bandwidth of the recording apparatus,~~ and

– recording the multilevel code on ~~the~~ a record carrier.

2. (amended) ~~A~~ The method ~~as claimed in~~ of Claim 1 in which the multilevel code ~~comprises~~ includes a signal having more than two amplitude levels that provide respective code levels.

3. (amended) ~~A~~ The method ~~as claimed in~~of Claim 1 in which the multilevel code has four code levels and the lower data rate is half of the standard teletext data rate.

4. (amended) ~~A~~ The method of Claim 1 in which the multilevel code has eight code levels and the lower data rate is one third of the standard teletext data rate.

5. (amended) A method of replaying teletext data ~~from a record carrier using replay apparatus having a bandwidth of less than the standard teletext data rate, the teletext data being recorded on the record carrier by means of a multilevel code at a data rate which is lower than the standard teletext data rate, the method~~ comprising the steps of:

- reading ~~the~~ a multilevel code from ~~the~~ a record carrier, the multilevel code having more than two code levels;
- converting the multilevel code to standard teletext data, and
- applying the teletext data to a teletext encoder.

6. (amended) Apparatus for recording teletext data ~~on a record carrier, said apparatus having a bandwidth of less than the standard teletext data rate, the apparatus~~, comprising:

means for receiving a video signal including teletext data,

means for detecting received valid teletext data,

means for encoding the received teletext data into a multi-level code having more than two code levels, at a data rate which is less than the standard teletext data rate, and

means for recording the multilevel code on the record carrier.

7. (amended) ~~Apparatus~~ The apparatus ~~as claimed in~~ of Claim 6 in which the means for encoding teletext data ~~comprises~~ include:

means for applying the received teletext data to an encoder in n-bit packets, where n is greater than one,

means for converting each n-bit packet into a multilevel code having at least one level for each n-bit combination, and

means for feeding the multibit code to the ~~record~~ recording head of the recorder at a data rate of 1/n times the standard teletext data rate.

8. (amended) ~~Apparatus~~ The apparatus ~~as claimed in~~of Claim ~~6~~ 7 in which n=2.

9. (amended) ~~Apparatus~~ The apparatus ~~as claimed in~~ of Claim ~~6~~ 7 in which n=3.

10. (amended) ~~Apparatus~~ The apparatus ~~as claimed in~~of Claim 6 ~~in which~~ further comprising a buffer RAM ~~is~~ connected between the means for detecting teletext data and the ~~encoder~~ means for encoding.

11. (amended) ~~Apparatus~~ The apparatus ~~as claimed in~~of Claim 10 in which:

the buffer RAM receives only teletext data packets; and

the ~~encoder includes means for generating the~~ encoding means generate a clock run in and a framing code.

12. (amended) ~~Apparatus~~ The apparatus ~~as claimed in~~of Claim 6 in which the multilevel code ~~comprises~~ includes a plurality of amplitude levels that provide respective code levels.

13. (amended) Apparatus for replaying teletext data ~~from a record carrier, the teletext data being encoded by means of a multilevel~~

~~code at a data rate less than the standard teletext data rate, the apparatus,~~ comprising:

means for feeding ~~the~~ a multilevel code signal having more than 2 code levels, to a decoder ~~which is arranged~~ to convert the multilevel code to a binary code at the standard teletext data rate; and

means for multiplexing the binary code with the video signal for application to a teletext decoder.

14. (amended) ~~Apparatus~~ The apparatus ~~as claimed in~~ of Claim 13 in which the multilevel code is a four level code and the decoder produces two bits from each four level code.

15. (amended) The apparatus ~~Apparatus as claimed in~~ of Claim 13 in which the multilevel code is an eight level code and the decoder produces three bits from each eight level code.

16. (amended) The apparatus ~~Apparatus as claimed in~~ of Claim 13 in which data from the decoder is written into a buffer RAM.

17. (amended) The apparatus ~~Apparatus as claimed in~~ of Claim 16 further comprising a teletext encoder ~~, the teletext encoder being arranged~~ to receive data from the buffer RAM.

18. (amended) The apparatus~~Apparatus as claimed in~~ of Claim 16 in which the teletext encoder includes means for generating the clock run-in and framing code.

19. (amended) ~~Apparatus~~ The apparatus ~~as claimed in~~of Claim 13 in which the decoder includes an ~~equaliser~~ equalizer.

20. (amended) ~~Apparatus~~ The apparatus ~~as claimed in~~of 9 in which the equalizer ~~equaliser~~ is a decision feedback equalizer~~equaliser~~.

21. (amended) ~~Apparatus~~ The apparatus ~~as claimed in~~of Claim 13 in which the multilevel code ~~comprises~~ includes a plurality of amplitude levels that provide respective code levels.

ABSTRACT OF THE DISCLOSURE

Standard binary teletext signals (which have a data rate exceeding the bandwidth of a standard VHS video recorder) are converted into a multilevel code so that the teletext data can be reliably recorded and replayed by a standard VHS video recorder. During recording teletext data is received at a high data rate and encoded in accordance with a multilevel code at a lower data rate and within the bandwidth of the VCR. During playback the multilevel code is decoded back into binary code at the standard teletext data rate and clock run-in and framing codes are added to provide standard teletext signal. The resulting teletext data is then combined with the video signal.